erally poorly exposed. The beds are purplish or reddish brown, fine grained and contain a variable though small proportion of calcite as the cement. Thin lenses of limestone and shale are interbedded with the sandstone. The greater part of the upper division is made up of sandy limestone, which is dark gray to almost black on fresh fracture but which weathers to shades of light brown to pinkish. Nodules of dark gray to black chert are abundant and many be as large as a foot in diameter. Interbedded with the limestones and gradational into them are calcareous sandstones. A few beds of relatively pure limestone may also be found. No complete sections of this formation were found in any of the three facies, but it is probable that there is no great difference in thickness or lithology between the three. The thickest continuous section found measured 1,000 feet but the top was not exposed. The total thickness probably does not exceed 1500 feet, however. A large number of fossil collections were made from the formation and Doctor Girty, who examined them, writes that they indicate an upper Mississippian age.

Ochre Mountain limestone.—This formation takes its name from the fact that it is well exposed on Ochre Mt. It is composed almost entirely of massively bedded limestones, which are usually brownish gray on fresh fracture and weather to a light bluish gray color. Most of them are fine-grained, but there are local coarser beds. Individual beds may be as much as 10 feet in thickness and almost all are more than a foot thick. The basal few hundred feet of the formation includes beds that contain large amounts of chert, some beds being considerably more than half chert. The chert is generally light gray in color but weathers to a characteristic tan. About 1700 feet above the base of the western facies lies a thin and poorly exposed horizon of black shale interbedded with sandstone which is here named the Herat shale member from exposures near the Herat claims. No lithologic distinction could be made between the central and western facies of this formation. The thickness of the Ochre Mountain limestone was not accurately determined but it appears to be about 4500 feet. It is locally abundantly fossiliferous, and Doctor Girty reports that the fossil collections made prove that the formation, like the underlying Woodman formation, is of upper Mississippian age.

Manning Canyon formation.—Both the central and western facies of the beds here identified with the Manning Canyon shale of the Oquirrh Mountains are composed almost entirely of dark quartzites and sandy shales, and black shales. The first two are relatively more abundant in the central facies, and the latter in the western facies. Limestone

beds are found only locally. The exposed thickness of the formation is very variable, ranging from only a few feet to more than 1,000 feet, but this variation appears in part at least due to the fact that the weak shales have been the locus of considerable low-angle faulting. A number of fossils collected from the interbedded limestones are considered by Doctor Girty to indicate a Pottsville or lower Pennsylvanian age. In the Oquirrh Range, to the east Gilluly found high upper Mississippian fossils near the base of big Manning Canyon shales, and it is possible that if better exposures were present at Gold Hill, a similar fauna might also be found. The writer was not able to distinguish unconformable relations between them, however, but this may have been because of the widespread alteration and crushing at this horizon.

Oquirrh formation.—The eastern and western facies of the rocks here identified with the Oquirrh formation of the Oquirrh Mountains—are strikingly different. The central facies is made up of a number of different kinds of rocks. Each rock type is repeated over and over again throughout the section, and individual beds are generally lenticular, two features which render it impossible to subdivide the formation.

The facies is prevailingly sandy. Sandstones form about half of the section, and sandy limestones and sandy shales a large part of the remainder. Interbedded with these are numerous beds of limestone and dolomite and a few horizons of conglomerate. The western facies shows very little resemblance to the central. At the base is a moderate thickness of light-colored sandstone, above which is nearly 3,000 feet of massively bedded limestones, similar lithologically to those that make up the Ochre Mountain limestone. The remainder of the formation is composed of interbedded sandstones and dolomite with only minor amounts of limestone. The total thickness of the eastern facies is unknown as the top is nowhere exposed. At least 5300 feet of beds are shown at one locality, however. The western facies is considerably interrupted by faulting but a total thickness of about 8,000 feet must be present. The formation is abundantly fossiliferous. The lower few hundred feet of both facies contains a Pottsville fauna similar to that in the underlying Manning Canyon formation. The remainder of the Central facies and the bulk of the western facies is reported by Doctor Girty to belong to the higher Pennsylvanian. A few fossils collected from the upper part of the western facies proved to be of Permian age.

Gerster formation.—The Gerster formation, named for exposures in Gerster Gulch in the northwestern corner of the quadrangle, is made

up largely of thin bedded sandy and shaly limestones, which are brownish gray on fresh surfaces, and which weather to yellowish brown or pink. The beds are from 2 inches to a foot in thickness and generally have a concentration of sandy or shaly material along the bedding planes. Locally thin beds of sandstone may be found and in most exposures moderately thick beds of cherty limestone are also present. The formation is sharply set off from the underlying Oquirrh formation by its lithology and abundant fossil content. The thickness of the formation is approximately 600 feet in the one locality where the overlying Trissic is found. Doctor Girty reports that the fauna is that of the *Spiriferina pulchra* zone of the Permian.

PALEONTOLOGY.—*Contributions to the paleontology of Peru, IV:* "Orthophragmina" (Discocyclina) meroensis *W. Berry, n.sp.*[1] WILLARD BERRY, Ohio State University. (Communicated by JOHN B. REESIDE, JR.)

In a gritty greenish-brown calcareous sandstone at Calita Mero, Department of Piura, Peru, I have found a new species of *"Orthophragmina,"* which is here named *"O." meroensis.* This species, is associated with *O. stewarti* W. Berry, originally described from the Saman conglomerate at Calita Sal, in the same Department and about seventy miles south of Calita Mero. The Saman conglomerate is, so far as I know, the only formation in the Peruvian Tertiaries containing members of the genus *"Orthophragmina"* and I think I am safe, therefore, in saying that it is this formation which is exposed near Calita Mero. The matrix is similar to that at Calita Sal except that it contains few pebbles and many of the grains are subangular. The material was apparently laid down in shallow water, though the size of the particles and almost complete absence of pebbles suggest that the deposits at Calita Mero must have been farther from shore than at Calita Sal, or the land mass from which they were derived had been eroded so that less heavy and bulky material was being carried into the ocean at that point. In general the genus *"Orthophragmina"* lived in shallow, tropical waters which were fairly free from coarser clastic material, and the matrix of the fossils from Calita Mero is in agreement with this fact. From Calita Sal I have described also solitary corals. It would seem that in this general region during Saman conglomerate times little detrital material other than much angular quartz was being deposited.

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